Montana Oil Pipeline Safety Review Council

Waterway Crossing Risk Management

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INTEGRITY Solutions

MT Regulated Oil Pipelines

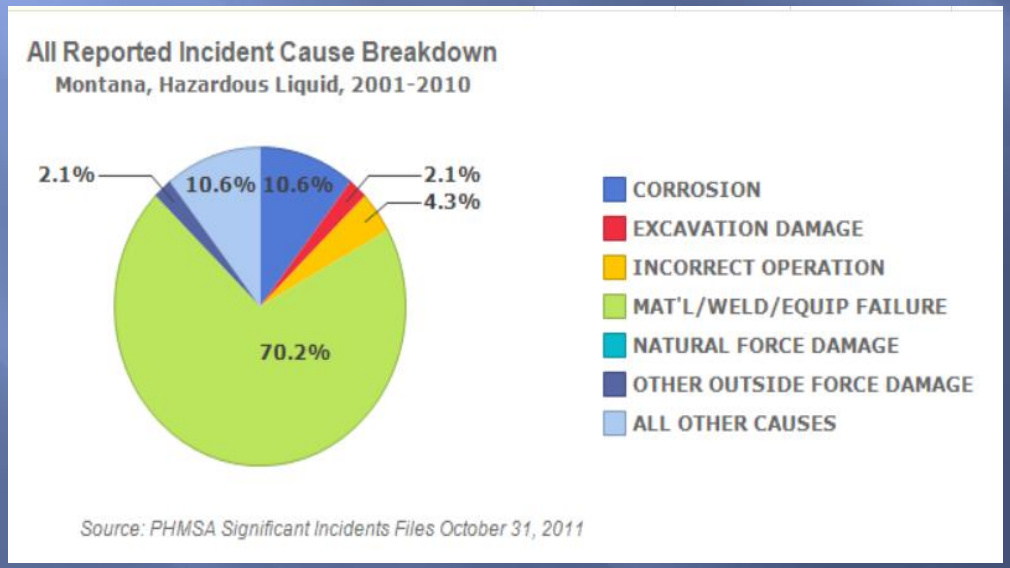
Montana has ~2,800 miles of hazardous liquid pipelines regulated by DOT PHMSA under 49 CFR Part 195:

- **Highly Volatile Liquids (all regulated, subject to IMP*)**
- **Commercial Navigable Waterway Crossings (all regulated, subject to IMP*)**
- **Transmission Pipelines**
  - **High Stress (all regulated, subject to IMP*)**
  - **Low Stress**
    - ✓ **Non-Rural (all regulated, subject to IMP*)**
    - ✓ **Rural (all regulated, some subject to IMP*)**
- **Gathering Pipelines**
  - **High Stress**
    - ✓ **Non-Rural (all regulated, subject to IMP*)**
    - ✓ **Rural (all regulated, not subject to IMP*)**
  - **Low Stress & Rural (none regulated)**
- **Production Pipelines (none regulated)**

Subject to 195.452 - Integrity Management Program (IMP) rules

MT Oil Pipeline Releases

Pipeline Commodity	Miles	%
CRD - Crude Oil	1,983	69.73%
LPG - Liquefied Petroleum Gas (HVL)	18	0.63%
NGL - Natural Gas Liquids (HVL)	9	0.32%
PRD - Refined Products	834	29.32%
Totals	2,844	100.00%



Year	Number Releases	Property Damage	Gross Barrels Spilled	Net Barrels Lost
2001	1	$92,925	30	15
2002	5	$32,390	1,001	499
2003	3	$14,526	129	13
2004	4	$82,980	76	25
2005	3	$39,629	42	17
2006	10	$90,871	49	22
2007	6	$56,884	321	9
2008	6	$514,352	183	12
2009	6	$2,992,669	2,485	742
2010	3	$198,223	93	3
Totals	47	$4,115,452	4,413	1,360

http://primis.phmsa.dot.gov/comm/reports/safety/MT_detail1.html?nocache=44#

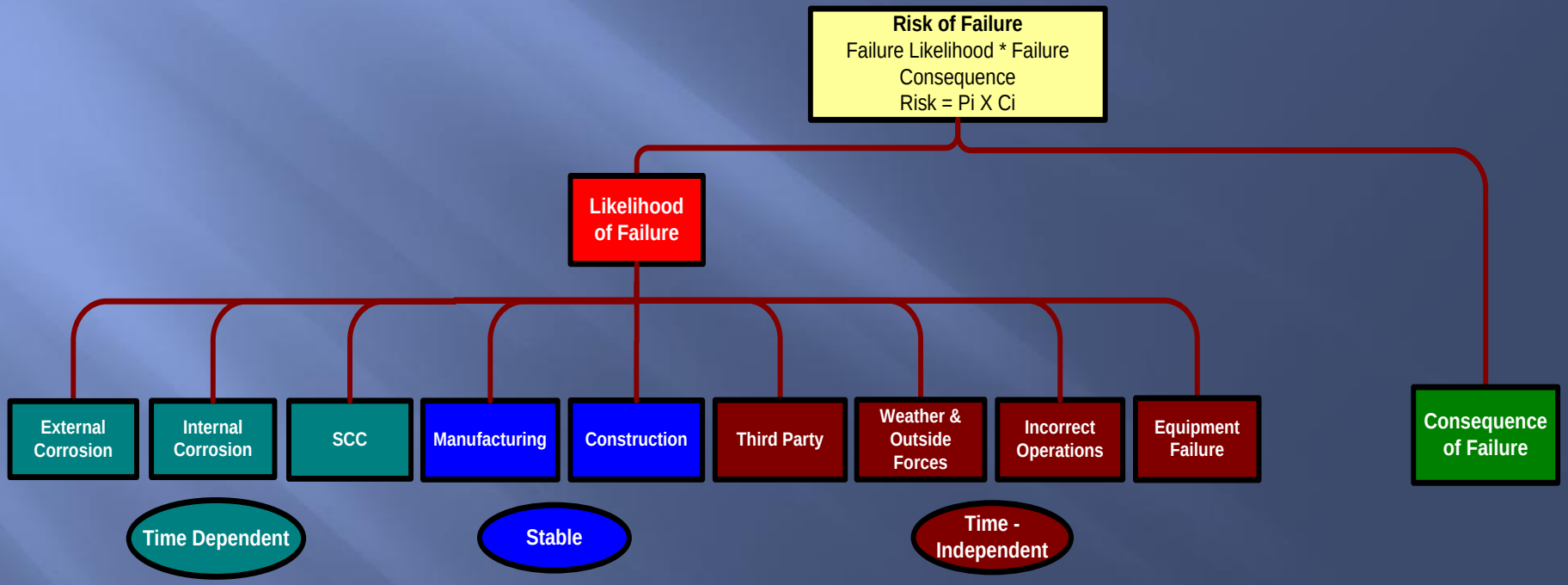
IMP Elements

Hazardous Liquid Pipeline Integrity Management Program (IMP) Elements: [49CFR 195.452]

1. **Identify High Consequence Areas**
2. **Perform Risk Analysis**
3. **Conduct Integrity Assessments**
4. **Remediate Conditions**
5. **Add Preventive and Mitigative Measures**
6. **Evaluate Program Performance**

The purpose of IMP regulations is to ensure public and environmental safety by managing pipeline integrity risk.

Risk Model Algorithm



Algorithm Variables

EXAMPLE:
Probability of Crossing Hydrotechnical Scouring (Ps)

Ps=(precip)*(hydro_crossing*hydro_class*hydro_confine*hydro_grad*hydro_flow*hydro_veg*hydro_nat_bank*hydro_nat_plain*(MAX(hydro_bank_rt,hydro_bank_lt))*hydro_slope_ROW*hydro_slide*hydro_debris*hydro_obst_US*…

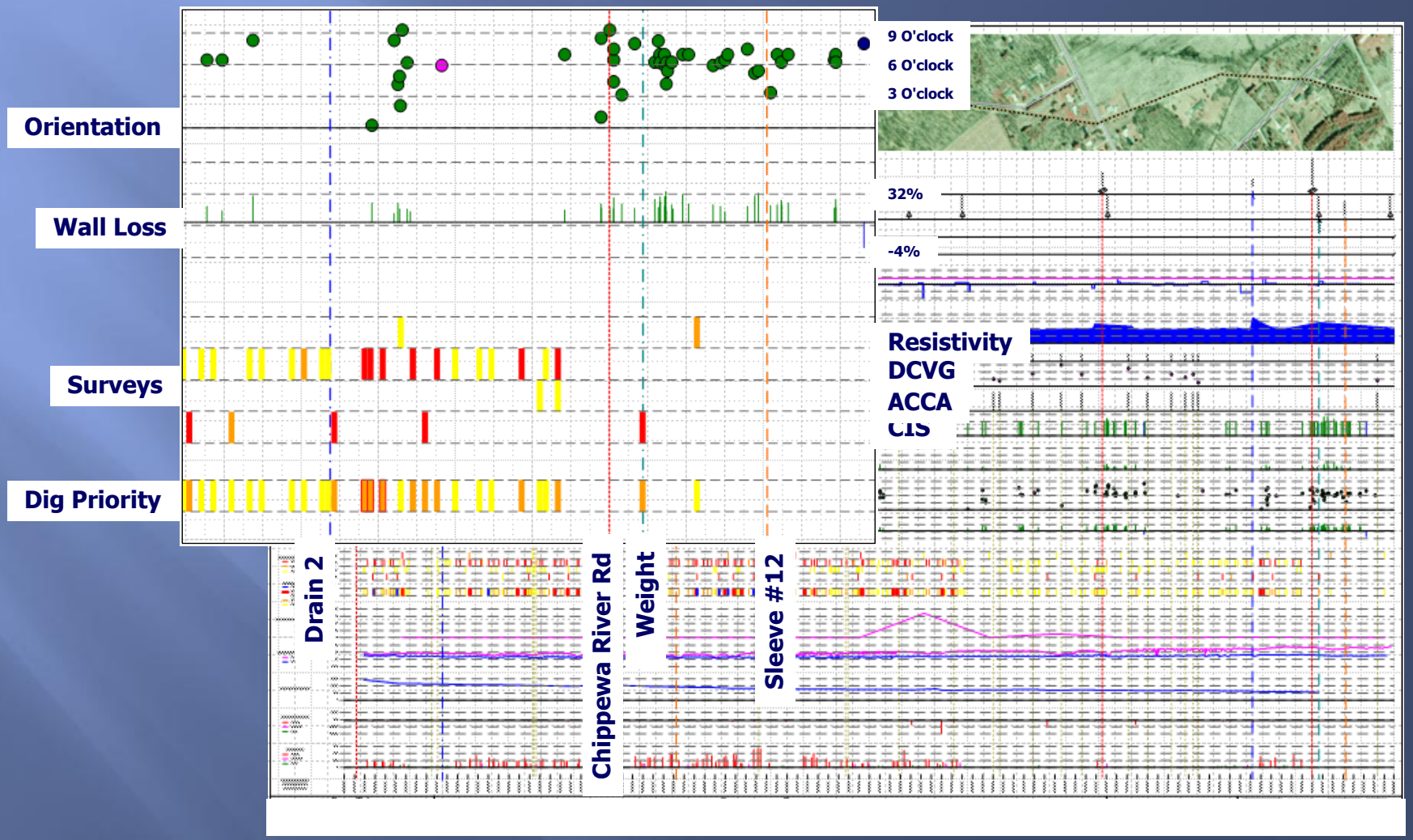
Vs=(pipe_wall_geo)*(hydro_bedload*hydro_size*hydro_vegetal*hydro_cross_type*hydro_cross_design*…

Pf(s) = Ps * Vs

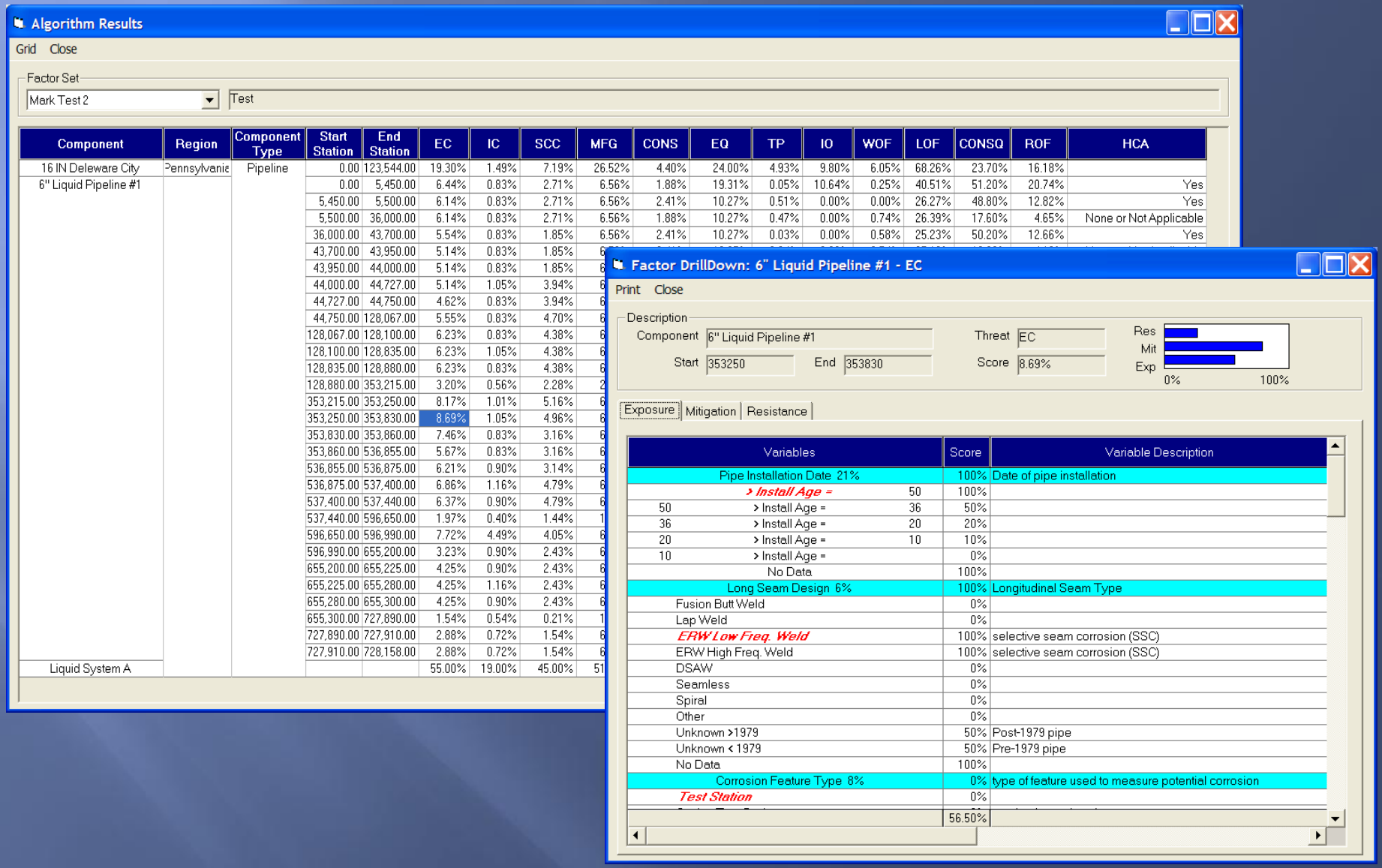
MT Oil Pipeline Crossing Data

- **The owner of the pipeline & product it is carrying**
- **The pipeline diameter & age**
- **The pipeline pressure**
- **The distance between shutoff and check valves, their condition, their proximity to the pump stations, and the location of pressure gauges**
- **The pipeline thickness and degree of corrosion**
- **The pipeline burial depth and the degree of river scouring and meandering.**

Segment Data Integration



Segment Risk Ranking



Algorithm Results

Grid Close

Factor Set: Mark Test 2 — Test

Component	Region	Component Type	Start Station	End Station	EC	IC	SCC	MFG	CONS	EQ	TP	IO	WOF	LOF	CONSQ	ROF	HCA
16 IN Deleware City	Pennsylvania	Pipeline	0.00	123,544.00	19.30%	1.49%	7.19%	26.52%	4.40%	24.00%	4.93%	9.80%	6.05%	68.26%	23.70%	16.18%	
6" Liquid Pipeline #1			0.00	5,450.00	6.44%	0.83%	2.71%	6.56%	1.88%	19.31%	0.05%	10.64%	0.25%	40.51%	51.20%	20.74%	Yes
			5,450.00	5,500.00	6.14%	0.83%	2.71%	6.56%	2.41%	10.27%	0.51%	0.00%	0.00%	26.27%	48.80%	12.82%	Yes
			5,500.00	36,000.00	6.14%	0.83%	2.71%	6.56%	1.88%	10.27%	0.47%	0.00%	0.74%	26.39%	17.60%	4.65%	None or Not Applicable
			36,000.00	43,700.00	5.54%	0.83%	1.85%	6.56%	2.41%	10.27%	0.03%	0.00%	0.58%	25.23%	50.20%	12.66%	Yes
			43,700.00	43,950.00	5.14%	0.83%	1.85%	6									
			43,950.00	44,000.00	5.14%	0.83%	1.85%	6									
			44,000.00	44,727.00	5.14%	1.05%	3.94%	6									
			44,727.00	44,750.00	4.62%	0.83%	3.94%	6									
			44,750.00	128,067.00	5.55%	0.83%	4.70%	6									
			128,067.00	128,100.00	6.23%	0.83%	4.38%	6									
			128,100.00	128,835.00	6.23%	1.05%	4.38%	6									
			128,835.00	128,880.00	6.23%	0.83%	4.38%	6									
			128,880.00	353,215.00	3.20%	0.56%	2.28%	2									
			353,215.00	353,250.00	8.17%	1.01%	5.16%	6									
			353,250.00	353,830.00	8.69%	1.05%	4.96%	6									
			353,830.00	353,860.00	7.46%	0.83%	3.16%	6									
			353,860.00	536,855.00	5.67%	0.83%	3.16%	6									
			536,855.00	536,875.00	6.21%	0.90%	3.14%	6									
			536,875.00	537,400.00	6.86%	1.16%	4.79%	6									
			537,400.00	537,440.00	6.37%	0.90%	4.79%	6									
			537,440.00	596,650.00	1.97%	0.40%	1.44%	1									
			596,650.00	596,990.00	7.72%	4.49%	4.05%	6									
			596,990.00	655,200.00	3.23%	0.90%	2.43%	6									
			655,200.00	655,225.00	4.25%	0.90%	2.43%	6									
			655,225.00	655,280.00	4.25%	1.16%	2.43%	6									
			655,280.00	655,300.00	4.25%	0.90%	2.43%	6									
			655,300.00	727,890.00	1.54%	0.54%	0.21%	1									
			727,890.00	727,910.00	2.88%	0.72%	1.54%	6									
			727,910.00	728,158.00	2.88%	0.72%	1.54%	6									
Liquid System A					55.00%	19.00%	45.00%	51									

Factor DrillDown: 6" Liquid Pipeline #1 - EC

Print Close

Description

Component: 6" Liquid Pipeline #1 — Threat: EC

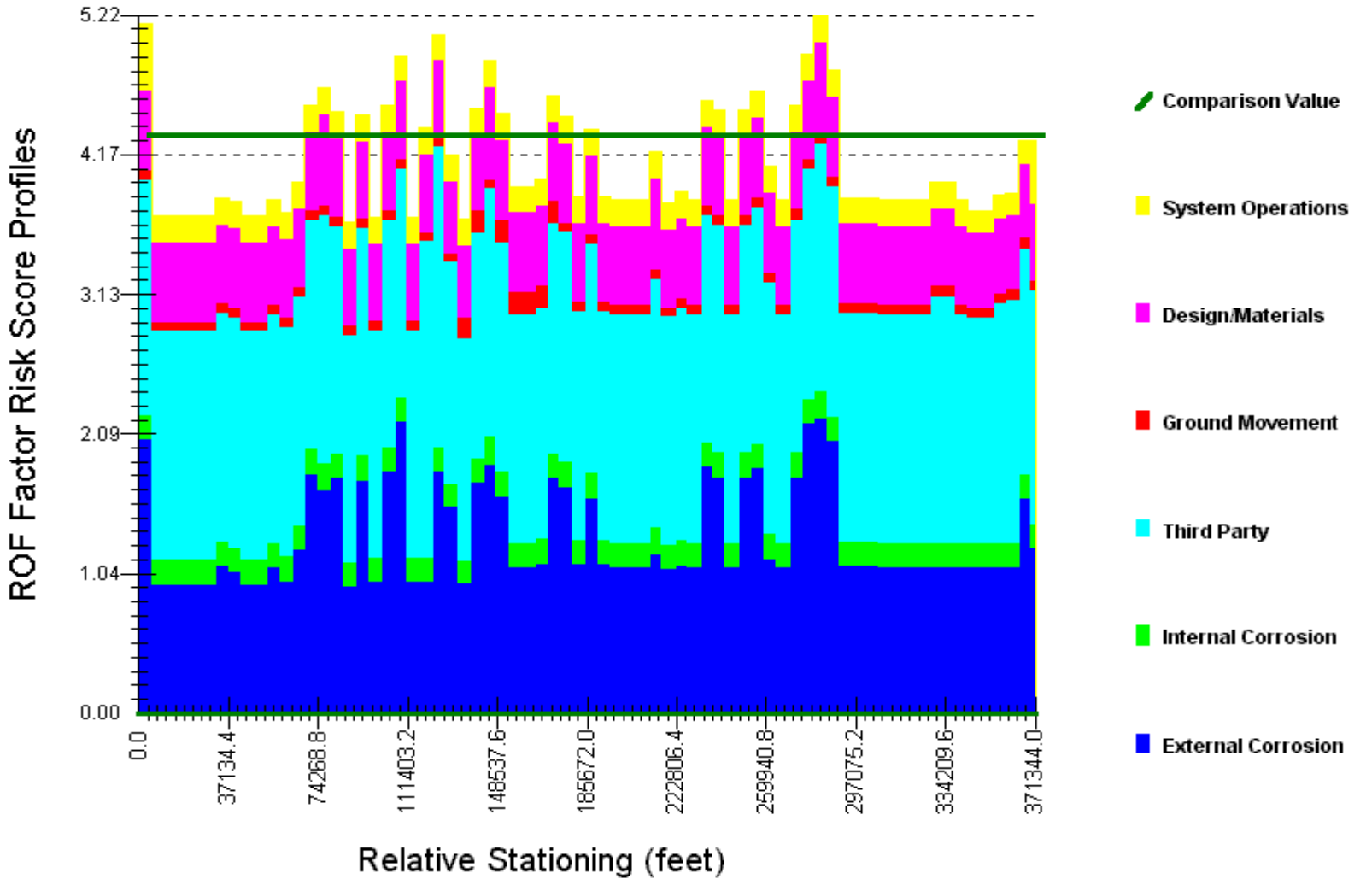
Start: 353250 — End: 353830 — Score: 8.69%

Res / Mit / Exp — 0% 100%

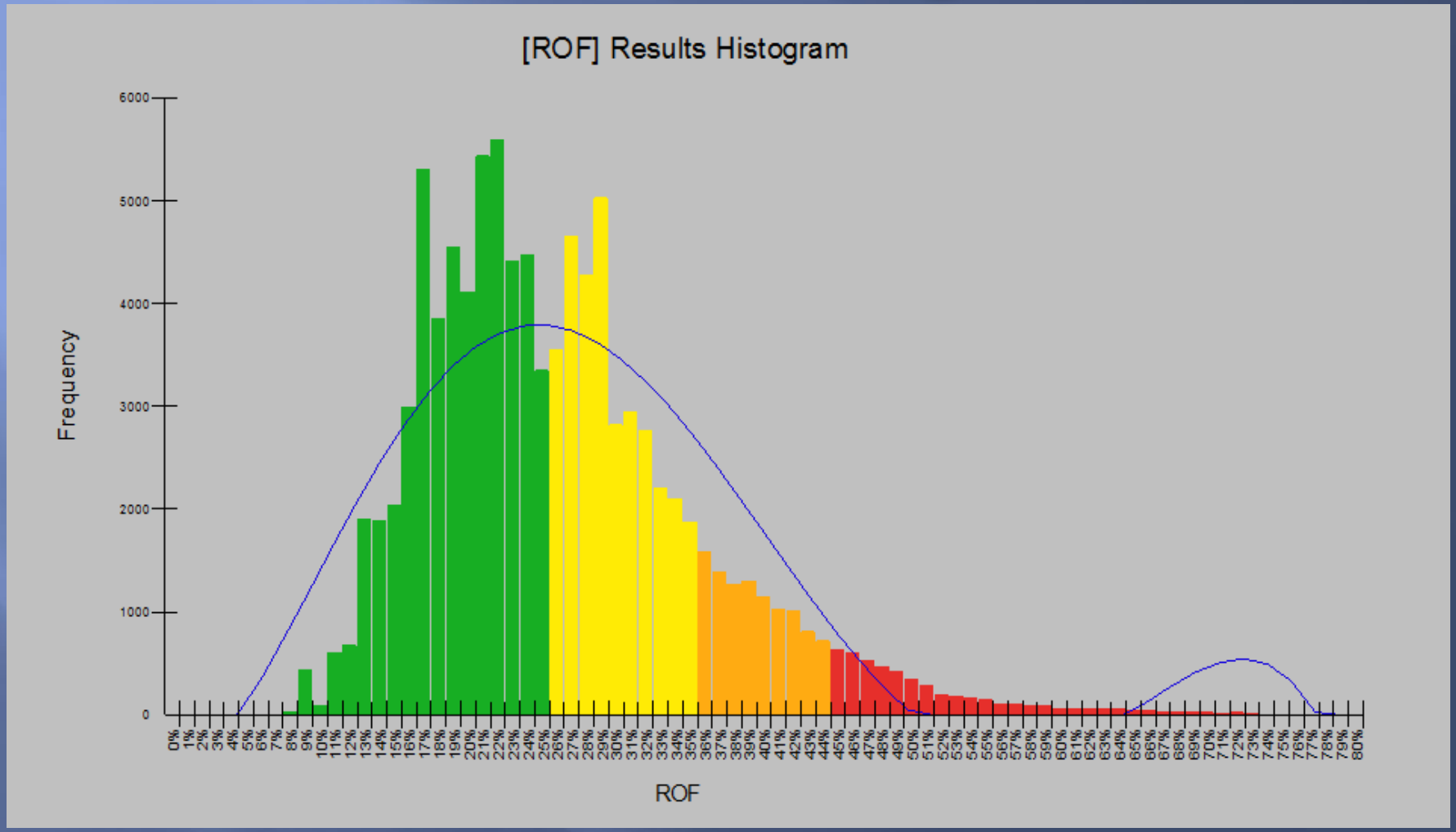
Exposure | Mitigation | Resistance

Variables			Score	Variable Description
Pipe Installation Date 21%			100%	Date of pipe installation
> Install Age =		50	100%	
50	> Install Age =	36	50%	
36	> Install Age =	20	20%	
20	> Install Age =	10	10%	
10	> Install Age =		0%	
No Data			100%	
Long Seam Design 6%			100%	Longitudinal Seam Type
Fusion Butt Weld			0%	
Lap Weld			0%	
ERW Low Freq. Weld			100%	selective seam corrosion (SSC)
ERW High Freq. Weld			100%	selective seam corrosion (SSC)
DSAW			0%	
Seamless			0%	
Spiral			0%	
Other			0%	
Unknown >1979			50%	Post-1979 pipe
Unknown < 1979			50%	Pre-1979 pipe
No Data			100%	
Corrosion Feature Type 8%			0%	type of feature used to measure potential corrosion
Test Station			0%	
			56.50%	

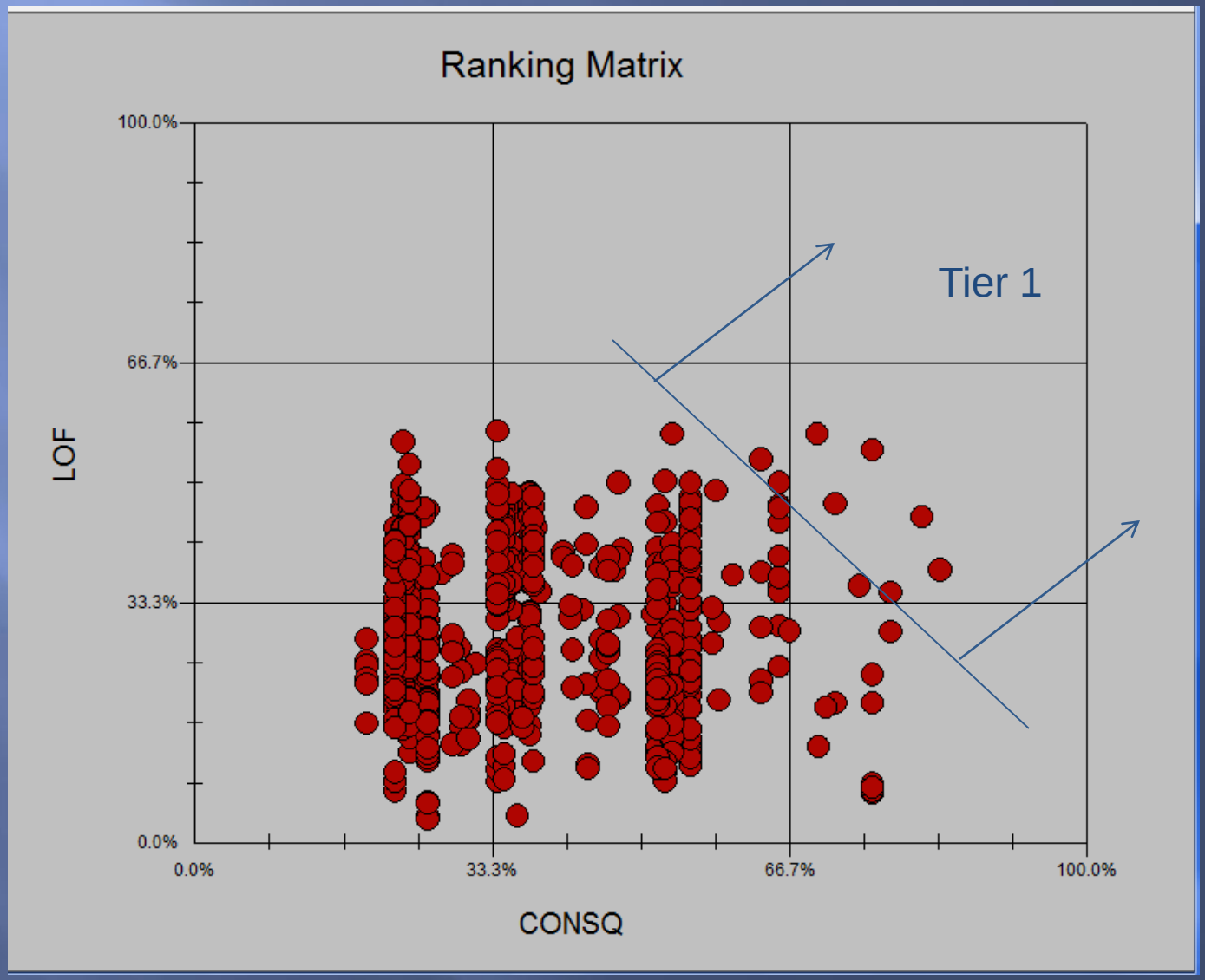
Risk Analysis Results



Risk of Failure – Tiered Histogram



Risk Ranking Matrix



Preventive & Mitigative Measures

Additional Preventive & Mitigative (P&M) Measures to protect waterways may include; [195.452(i)]

- **Emergency Flow Restriction Devices (EFRDs),**
- **Pressure and leak detection,**
- **Damage prevention practices,**
- **Shorter inspection intervals, and**
- **Local emergency response training/drills.**

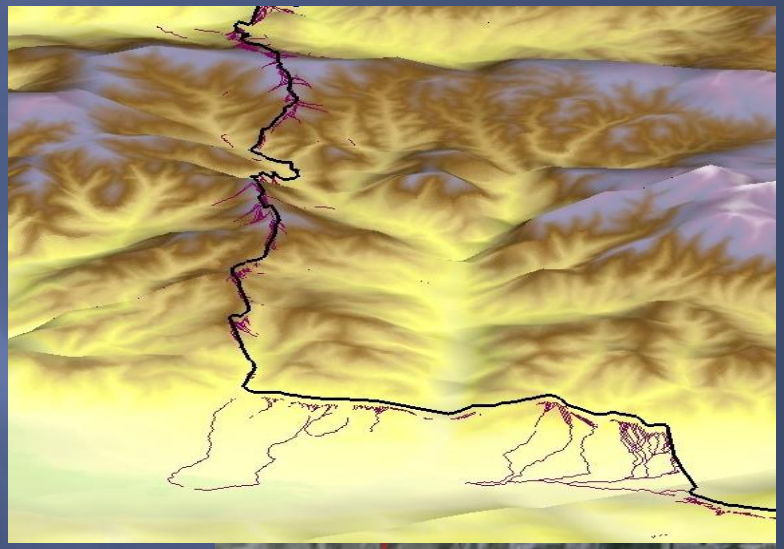
HCA Analysis

The HCA analysis process for pipeline facilities is managed in three independent parts: [195.450)]

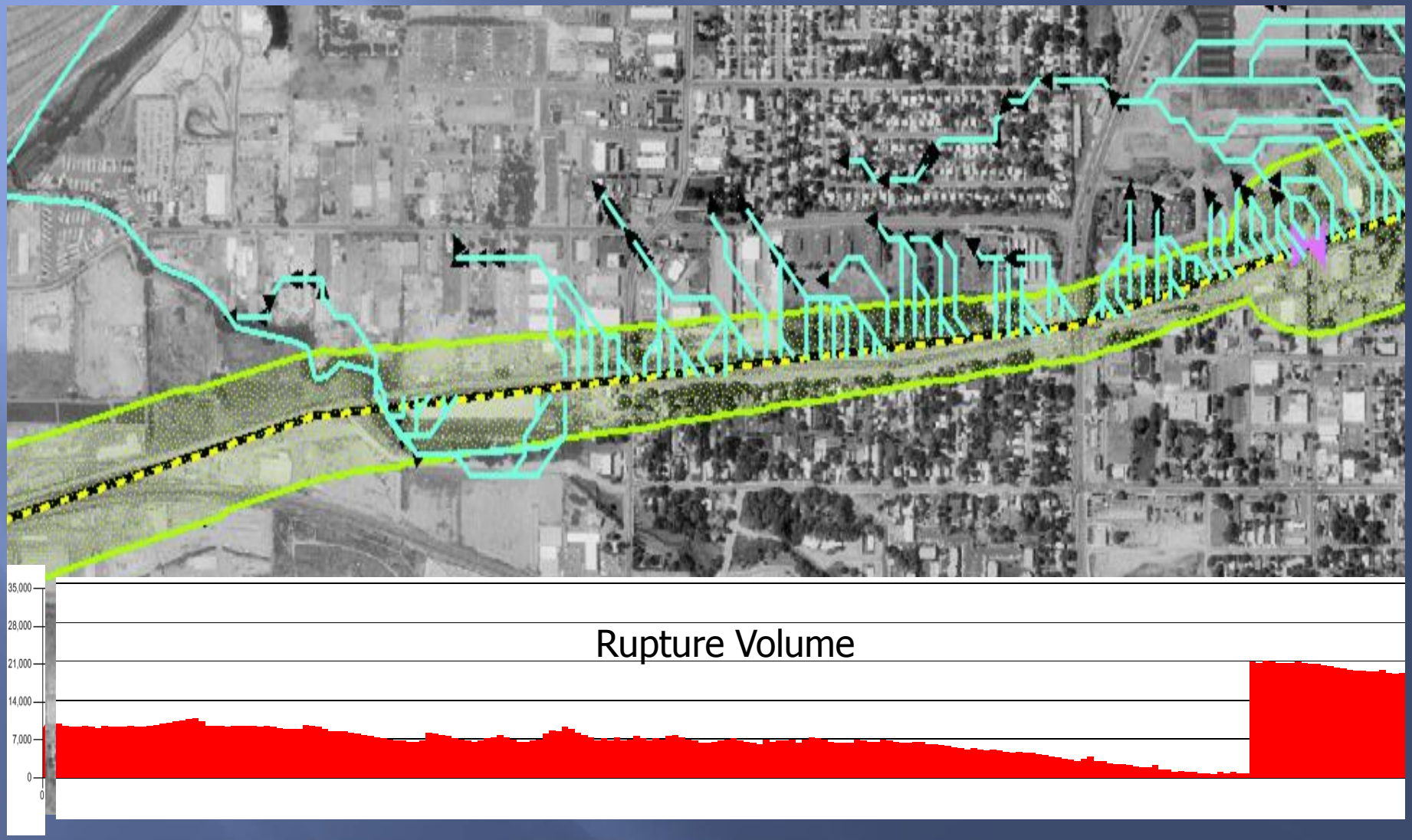
1. Immediate Impact – Identifies release points directly within an HCA.

2. Potential Migration Impact – Identifies if product from the release point has the potential to migrate as an area sheet flow downhill to an HCA (also considers air dispersion model).

3. Watershed Transmission Impact – Identifies if product from the release point, and resulting potential sheet flow area, has the potential to enter any water feature that will transport it miles downstream to an HCA.



EFRD Analysis

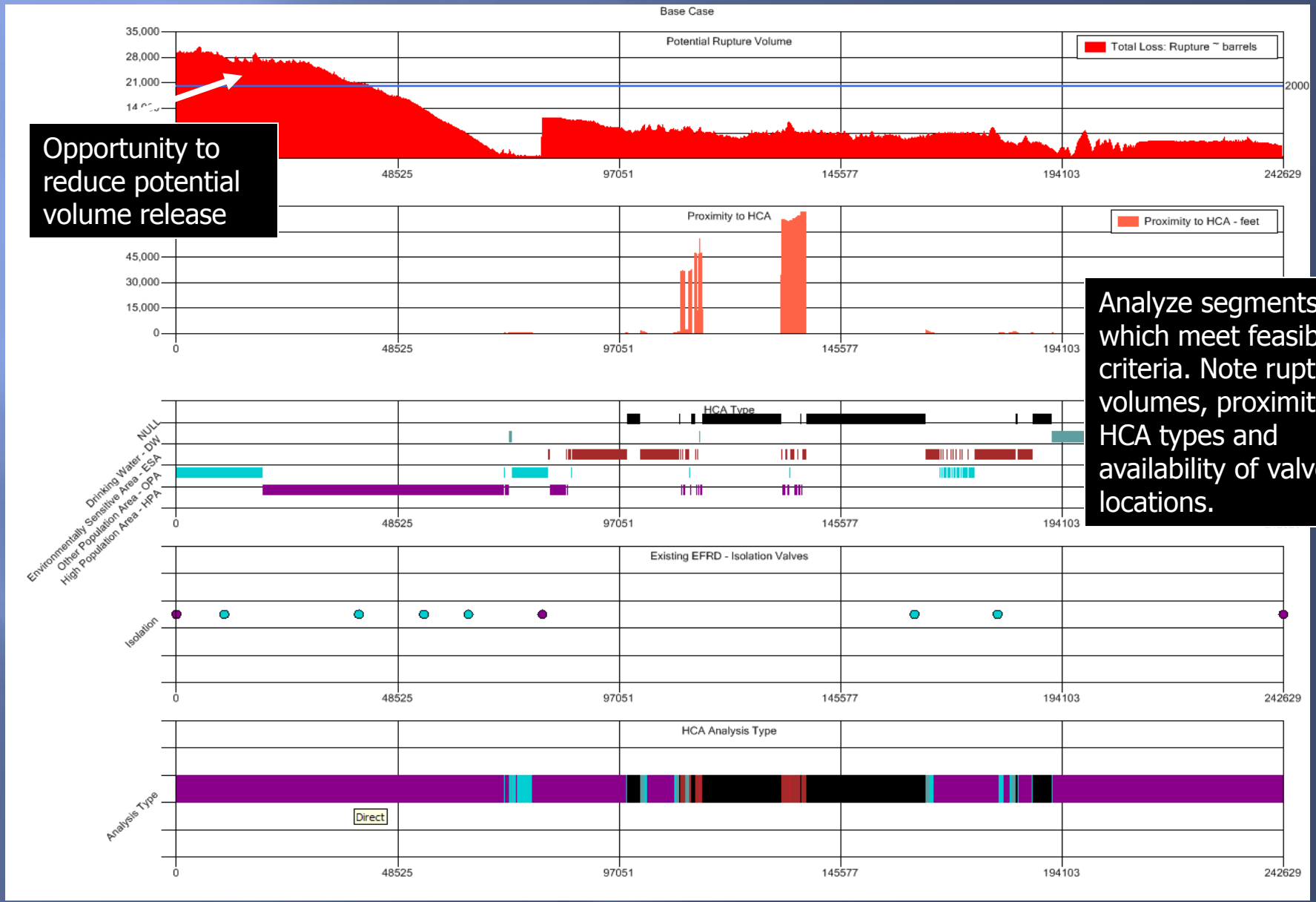


EFRD Factors

- **If operator determines that an EFRD is needed on a pipeline segment they must install the EFRD.**

- **Factors considered to determine if additional EFRD is needed;**
  - ✓ **Type of product carried,**
  - ✓ **Rate of potential leakage/rupture,**
  - ✓ **The volume that can be released (initial & drain down),**
  - ✓ **Swiftness of leak/rupture detection and pipeline shutdown capabilities,**
  - ✓ **Pipeline elevation profile,**
  - ✓ **Potential for ignition,**
  - ✓ **Proximity to power sources,**
  - ✓ **Location of nearest response personnel,**
  - ✓ **Terrain between the pipeline segment and HCA, and**
  - ✓ **Benefits by reduced spill size.**

EFRD Factors




WARNING
PETROLEUM